What is claimed is:

1. A method for exciting ions of a predetermined mass-to-charge ratio at a resonant frequency, the method comprising the steps of:

generating an excitation signal including a fundamental frequency and at least one secondary frequency greater than the fundamental frequency, the at least one secondary frequency including the resonant frequency; and

applying the excitation signal to the ions.

2. The method of claim 1, wherein the at least one secondary frequency includes a harmonic frequency of the fundamental frequency and the resonant frequency is the harmonic frequency.

3. The method of claim 1, wherein the at least one secondary frequency includes an alias frequency of the fundamental frequency and the resonant frequency is the alias frequency.

4. The method of claim 1, further comprising the step of filtering the excitation frequency before applying it to the excitation plates.

5. The method of claim 1, further comprising the step of filtering the excitation signal to substantially remove the fundamental frequency.

6. The method of claim 1, wherein the excitation signal comprises a signal having a substantially square waveform.

7. The method of claim 6, wherein the step of generating an excitation signal further comprises setting a conversion rate of a digital-to-analog converter (DAC) to a value obtained by dividing the resonant frequency by an odd integer.

8. The method of claim 7, wherein the odd integer is 3.

9. The method of claim 7, wherein the at least one secondary frequency includes a harmonic frequency of the fundamental frequency and the resonant frequency is the harmonic frequency.

10. The method of claim 1, wherein the step of generating an excitation signal further comprises generating a sampled sinusoidal waveform having a sampling rate C and fundamental frequency f wherein the resonant frequency is given by one of $nC+f$ and $(n+1)C-f$, where n is a non-negative integer.

11. The method of claim 10, further comprising the step of passing the excitation signal through a band pass filter to remove unwanted frequencies.

12. The method of claim 10, wherein the at least one secondary frequency includes an alias frequency of the fundamental frequency and the resonant frequency is the alias frequency.

13. The method of claim 1, wherein the ions are excited by inducing the ions to orbit between excitation plates, and the step of applying the excitation signal to the ions includes applying the excitation signal to the excitation plates.

14. The method of claim 1, wherein the excitation signal ejects a first portion of the ions from the cell, permitting detection of a second portion of the ions.

15. An apparatus for inducing ions of a predetermined mass-to-charge ratio to orbit at a resonant frequency, comprising:

a digital signal processor (DSP) configured to output a digital signal comprising a fundamental frequency;

a digital-to-analog converter (DAC) connected to the DSP for converting the digital signal to an analog excitation signal including the fundamental frequency and at least one secondary frequency greater than the fundamental frequency, the at least one secondary frequency including the resonant frequency; and

excitation plates connected to the DAC for applying the excitation signal to the ions.

16. The apparatus of claim 15, wherein the at least one secondary frequency includes a harmonic frequency of the fundamental frequency and the resonant frequency is the harmonic frequency.

17. The apparatus of claim 15, wherein the at least one secondary frequency includes an alias frequency of the fundamental frequency and the resonant frequency is the alias frequency.

18. The apparatus of claim 5, further comprising a filter for substantially removing at least one frequency from the excitation signal before it is applied to the plates.

19. The apparatus of claim 18, wherein the filter is a band pass filter that passes frequencies at and around the resonant frequency.

20. The apparatus of claim 18, wherein the filter removes the fundamental frequency from the excitation signal.

21. The apparatus of claim 15, wherein the DSP is further configured to output a square wave to the DAC.

22. The apparatus of claim 21, wherein the DAC is further configured to have a conversion rate obtained by dividing the resonant frequency by an odd integer.

23. The apparatus of claim 15, wherein the DAC is configured to generate a sampled sinusoidal waveform having a sampling rate C and frequency f wherein the resonant frequency is given by one of $nC+f$ and $(n+1)C-f$, where n is a non-negative integer.

24. The apparatus of claim 15, wherein the excitation signal contains a plurality of secondary frequencies corresponding to a plurality of resonant frequencies of ions of a plurality of predetermined mass-to-charge ratios.

25. The apparatus of claim 15, wherein the excitation signal induces the ions to orbit between the excitation plates.

26. The apparatus of claim 15, wherein the excitation signal induces the ions to orbit outside the excitation plates.

27. A computer-readable medium storing instructions that, when executed by one or more processors, cause the one or more processors to perform activities comprising:

transmitting instructions to a digital signal processor to generate a digital output including a signal at a fundamental frequency;

transmitting instructions to cause a digital-to-analog converter to convert the digital output to an analog excitation signal including the fundamental frequency and at least one secondary frequency greater than the fundamental frequency, and to output the excitation signal to excitation plates of a mass spectrometer; and

receiving and interpreting a detection signal from detection plates of the mass spectrometer, the detection signal generated by ions induced by the excitation plates to orbit at a resonant frequency equal to one of the secondary frequencies.

28. The computer readable medium of claim 27, wherein the at least one secondary frequency includes a harmonic frequency of the fundamental frequency and the resonant frequency is the harmonic frequency.

29. The computer readable medium of claim 27, wherein the at least one secondary frequency includes an alias frequency of the fundamental frequency and the resonant frequency is the alias frequency.

30. The computer readable medium of claim 27, wherein the analog excitation signal is a sampled sinusoidal waveform having a sampling rate C and

frequency f wherein the resonant frequency is given by one of $nC+f$ and $(n+1)C-f$, where n is a non-negative integer.

31. The computer readable medium of claim 27, wherein the analog excitation signal contains a plurality of secondary frequencies, and the detection signal is generated by ions induced to orbit at a plurality resonant frequencies equal to a plurality of the secondary frequencies.

32. The computer readable medium of claim 27, wherein the excitation signal is filtered between the digital-to-analog converter and the excitation plates.

33. The computer readable medium of claim 32, wherein the filter is a band pass filter that passes the resonant frequency.

34. The computer readable medium of claim 32, wherein the filter removes the fundamental frequency.